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	Date:	**October 28, 2004**
TO:	**Name:**	**John K. Peng, Technolgy Center 2600**
	Company:	**USPTO**
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FROM:	**Sender:**	**William R. Haulbrook, Ph.D.**
	Number of Pages *INCLUDING* This Cover Sheet: 19	
	Re: Patent Application No. 10/017,148 Docket No. SNS-009B(7268/15)	

Comments:

PLEASE DELIVER TO JOHN K. PENG, TECHNOLGY CENTER 2600.

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Ramona Kremon Date Sent 10/28/2004 Time Sent 5:30

PATENT
Attorney Docket No. SNS-009B
(7268/15)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Jennings et al.	CONFIRMATION NO:	9301
SERIAL NO.:	10/017,148	GROUP NO.:	2671
FILING DATE:	December 14, 2001	EXAMINER:	Nguyen, Kimbinh T.
TITLE:	SYSTEMS AND METHODS FOR THREE-DIMENSIONAL MODELING		

CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this correspondence, and any documents referred to as attached hereto, is being transmitted to the United States Patent and Trademark Office via facsimile No. (703) 876-9306 on this 28th day of October, 2004.

William R. Haulbrook, Ph.D.

Dear Mr. Peng:

As we discussed by phone today, please find transmitted herewith a re-submission of the Amendment After Final, as well as, related documents that were originally submitted September 17, 2004, to the Patent Office. Enclosed items are listed below:

1.) Copy of date stamped Postcard and Date stamped Express Mail Label (1 pg.);
2.) Copy of original Certificate of Facsimile Transmission, dated September 17, 2004, along with confirmation of successful transmission (2 pgs.);
3.) Copy of original Transmittal Form dated September 17, 2004 (1 pg.);
4.) Copy of Amendment After Final Action, dated September 17, 2004 (13 pgs.); and
5.) This Certificate of Facsimile Transmission (1 pg.)

Respectfully submitted,

Date: October 28, 2004
Reg. No. 53,002

William R. Haulbrook, Ph.D.
Attorney for Applicants
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SNS-009B
(7268/15)

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Name of Applicants: Jennings, et al.
Serial Number: 10/017,148
Atty: William R. Haulbrook Ph.D.
Date: September 17, 2004
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FROM: (PLEASE PRINT) PHONE 617, 310-8427
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Alexandria, VA 22313-1450

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SNS-009B (7268/15)

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PATENT
Attorney Docket No. SNS-009B
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APPLICANT:	Jennings et al.	CONFIRMATION NO:	9301
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TITLE:	SYSTEMS AND METHODS FOR THREE-DIMENSIONAL MODELING		

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Katherine G. Jose

RESPONSE UNDER 37 C.F.R. §1.116
EXPEDITED PROCEDURE
ART UNIT 2671

Attached hereto is/are:

Transmittal Form (1 pg.); and
Amendment After Final Action (13 pgs.).

Total number of pages of this fax including cover: 15

Submitted herewith is an Amendment After Final Under 37 CFR 1.116 for entry in the above-identified case. Should any further correspondence be required, the sender cordially invites the Examiner to call him at (617) 310-8427.

3119825

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PATENT
Attorney Docket No. SNS-009B
(7268/15)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Jennings et al.	CONFIRMATION NO:	9301
SERIAL NO.:	10/017,148	GROUP NO.:	2671
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Katherine G. Jose

RESPONSE UNDER 37 C.F.R. §1.116
EXPEDITED PROCEDURE
ART UNIT 2671

Attached hereto is/are:

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TRANSMITTAL FORM

Application Serial Number	10/017,148
Filing Date	December 14, 2001
First Named Inventor	Jennings et al.
Group Art Unit	2671
Examiner Name	Nguyen, Kimbinh T.
Attorney Docket No.	SNS-009B
Confirmation No.	9301
Issue Date	Not applicable

ENCLOSURES *(check all that apply)*

- ☐ Fee Transmittal Form
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SIGNATURE BLOCK

Respectfully submitted,

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PATENT
Attorney Docket No. SNS-009B
(7268/15)

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APPLICANT:	Jennings et al.	CONFIRMATION NO:	9301
SERIAL NO.:	10/017,148	GROUP NO.:	2671
FILING DATE:	December 14, 2001	EXAMINER:	Nguyen, Kimbinh T.
TITLE:	SYSTEMS AND METHODS FOR THREE-DIMENSIONAL MODELING		

RESPONSE UNDER 37 C.F.R. §1.116
EXPEDITED PROCEDURE
ART UNIT 2671

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AMENDMENT AFTER FINAL ACTION UNDER 37 C.F.R. § 1.116

This paper is responsive to the Office action, Paper No. 9, mailed from the United States Patent and Trademark Office on August 4, 2004, in the above-identified patent application. Applicants respectfully request that the amendments and remarks that follow be considered, and that the rejections made in the Office action be withdrawn. Applicants submit that in view of the amendments and remarks herein, all claims are in condition for allowance.

Applicants believe that no fee is required for this filing, but if any fee is due, the Director of the United States Patent and Trademark Office is hereby authorized to charge any such fee to Deposit Account No. 20-0531.

In response to the Office action of August 4, 2004, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 11 of this paper.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (currently amended) A method of modifying a virtual object stored within a computer, the method comprising the steps of:

representing a virtual object as a volumetric model;

converting a subset of the volumetric model into a non-volumetric representation;

modifying the non-volumetric representation according to a stimulus, thereby simulating a deformation of the virtual object while preserving surface detail; and

modifying the volumetric model so as to substantially represent the modified non-volumetric representation.

Claim 2 (previously presented) The method of claim 1, wherein modifying the non-volumetric representation according to a stimulus comprises modifying the non-volumetric representation according to a first stimulus and further modifying the non-volumetric representation according to a second succeeding stimulus.

Claim 3 (previously presented) The method of claim 1, wherein modifying the volumetric model comprises a change in shape of the volumetric model.

Claim 4 (previously presented) The method of claim 1, wherein modifying the volumetric model comprises converting a response of the non-volumetric representation to the stimulus into a response of the volumetric model to the stimulus.

Claim 5 (original) The method of claim 1, wherein the subset of the volumetric model is the entire volumetric model.

Claim 6 (original) The method of claim 1, wherein the subset of the volumetric model is a portion of the volumetric model.

Claim 7 (original) The method of claim 1, wherein the volumetric model comprises voxels.

Claim 8 (original) The method of claim 1, wherein the volumetric model comprises values spaced in a three-dimensional grid.

Claim 9 (previously presented) The method of claim 1, wherein the non-volumetric representation comprises a surface representation.

Claim 10 (previously presented) The method of claim 1, wherein the non-volumetric representation comprises a set-of-triangles representation.

Claim 11 (original) The method of claim 10, wherein the stimulus comprises a weighted displacement function defined on vertices of the set-of-triangles representation.

Claim 12 (previously presented) The method of claim 1, wherein the non-volumetric representation comprises a selected one of a polygon set, a bezier surface, a b-spline surface, a procedural surface, and a NURBS representation.

Claim 13 (cancelled)

Claim 14 (original) The method of claim 1, wherein the stimulus is a stimulus from a user using a haptic interface.

Claim 15 (original) The method of claim 14, wherein the haptic interface is a force feedback interface.

Claim 16 (original) The method of claim 14, wherein the haptic interface has at least three degrees of force feedback.

Claim 17 (original) The method of claim 1, further comprising the step of displaying the virtual object on a computer display.

Claim 18 (previously presented) The method of claim 1, wherein the volumetric model and the non-volumetric representation comprise representations having different numbers of dimensions.

Claim 19 (previously presented) The method of claim 1, wherein the stimulus comprises at least one of a displacement function, a smoothing function, a warping function, a volumetric interference, an areal interference, a result of a simulation, a control point modification, a data re-fitting, and a force.

Claim 20 (previously presented) The method of claim 1, wherein the stimulus is applied to the object in real time.

Claim 21 (previously presented) The method of claim 1, further comprising the steps of:

transforming the non-volumetric representation into a third representation;

modifying the third representation in response to an applied stimulus; and

transforming the modified third representation to a modified volumetric representation.

Claim 22 (original) The method of claim 21, wherein transforming the modified third representation to the modified volumetric representation comprises generating an intermediate modified representation.

Claim 23 (previously presented) The method of claim 1, wherein the stimulus comprises a user motion in at least three-dimensional space.

Claim 24 (original) The method of claim 1, further comprising applying a feedback force to a user, the feedback force being generally consistent with a geometric shape of a modified virtual object.

Claim 25 (currently amended) A method of modifying a volumetric representation of an object, the method comprising the steps of:

transforming at least a portion of the volumetric representation into a polygonal set representation;

modifying the polygonal set representation, thereby simulating a deformation of the object while preserving surface detail; and

modifying the volumetric representation to substantially represent the modification made to the polygonal set representation.

Claim 26 (original) The method of claim 25, wherein the modification comprises a selected one of a displacement function, a smoothing function, a warping function, a volumetric interference, an areal interference, a result of a simulation, a control point modification, a data re-fitting, and a force.

Claim 27 (currently amended) A method of modifying a volumetric representation of an object, the method comprising the steps of:

transforming at least a portion of the volumetric representation into a surface-based representation;

modifying the surface-based representation, thereby simulating a deformation of the object while preserving surface detail; and

modifying the volumetric representation to substantially represent the modification made to the surface based representation.

Claim 28 (currently amended) A system for modifying a virtual object stored within a computer, the system comprising:

a representation module that represents a virtual object as a volumetric model;

a conversion module that converts a subset of the volumetric model into a non-volumetric representation;

an analytic module that modifies the non-volumetric representation according to a stimulus, thereby simulating a deformation of the virtual object while preserving surface detail; and

a modification module that modifies the volumetric model so as to substantially represent the modified non-volumetric representation.

Claim 29 (previously presented) The system of claim 28, wherein the analytic module that modifies the non-volumetric representation according to a stimulus comprises an analytic module that modifies the non-volumetric representation according to a first stimulus and further modifies the non-volumetric representation according to a second succeeding stimulus.

Claim 30 (previously presented) The system of claim 28, wherein the modification module that modifies the volumetric model comprises a modification module that changes a shape of the volumetric model.

Claim 31 (previously presented) The system of claim 28, wherein the modification module that modifies the volumetric model comprises a modification module that converts a response of the non-volumetric representation to the stimulus into a response of the volumetric model to the stimulus.

Claim 32 (original) The system of claim 28, wherein the subset of the volumetric model is the entire volumetric model.

Claim 33 (original) The system of claim 28, wherein the subset of the volumetric model is a portion of the volumetric model.

Claim 34 (original) The system of claim 28, wherein the volumetric model comprises voxels.

Claim 35 (original) The system of claim 28, wherein the volumetric model comprises values spaced in a three-dimensional grid.

Claim 36 (previously presented) The system of claim 28, wherein the non-volumetric representation comprises a surface representation.

Claim 37 (previously presented) The system of claim 28, wherein the non-volumetric representation comprises a set-of-triangles representation.

Claim 38 (original) The system of claim 37, wherein the stimulus comprises a weighted displacement function defined on vertices of the set-of-triangles representation.

Claim 39 (previously presented) The system of claim 28, wherein the non-volumetric representation comprises a selected one of a polygon set, a bezier surface, a b-spline surface, a procedural surface, and a NURBS representation.

Claim 40 (cancelled)

Claim 41 (original) The system of claim 28, wherein the stimulus is a stimulus from a user using a haptic interface.

Claim 42 (original) The system of claim 41, wherein the haptic interface is a force feedback interface.

Claim 43 (original) The system of claim 41, wherein the haptic interface has at least three degrees of force feedback.

Claim 44 (original) The system of claim 28, further comprising a display module that displays the virtual object on a computer display.

Claim 45 (previously presented) The system of claim 28, wherein the volumetric model and the non-volumetric representation comprise representations having different numbers of dimensions.

Claim 46 (previously presented) The system of claim 28, wherein the stimulus comprises at least one of a displacement function, a smoothing function, a warping function, a volumetric interference, an areal interference, a result of a simulation, a control point modification, a data re-fitting, and a force.

Claim 47 (previously presented) The system of claim 28, wherein the stimulus is applied to the object in real time.

Claim 48 (previously presented) The system of claim 28, further comprising:

a second transformation module that transforms the non-volumetric representation into a third representation;

a third modification module that modifies the third representation in response to an applied stimulus; and

a third transformation module that transforms the modified third representation to a modified volumetric representation.

Claim 49 (original) The system of claim 48, wherein the third transformation module that transforms the modified third representation to the modified volumetric representation comprises a transformation module that generates an intermediate modified representation.

Claim 50 (original) The system of claim 48, wherein at least two of the first, second and third modification modules are the same module.

Claim 51 (original) The system of claim 48, wherein at least two of the first, second and third transformation modules are the same module.

Claim 52 (previously presented) The system of claim 28, wherein the stimulus comprises a user motion in at least three-dimensional space.

Claim 53 (original) The system of claim 28, further comprising a force feedback module that applies a feedback force to a user, the feedback force being generally consistent with a geometric shape of a modified virtual object.

Claim 54 (currently amended) A system of modifying a volumetric representation of an object, the system comprising:

a transformation module that transforms at least a portion of the volumetric representation into a polygonal set representation;

a first modification module that modifies the polygonal set representation, thereby simulating a deformation of the object while preserving surface detail; and

a second modification module that modifies the volumetric representation to substantially represent the modification made to the polygonal set representation.

Claim 55 (original) The system of claim 54, wherein a selected one of the modification of the polygonal set representation and the modification of the volumetric representation comprises a selected one of a displacement function, a smoothing function, a warping function, a volumetric interference, an areal interference, a result of a simulation, a control point modification, a data re-fitting, and a force.

Claim 56 (currently amended) A system of modifying a volumetric representation of an object, the system comprising:

a transformation module that transforms at least a portion of the volumetric representation into a surface-based representation;

a first modification module that modifies the surface-based representation, thereby simulating a deformation of the object while preserving surface detail; and

a second modification module that modifies the volumetric representation to substantially represent the modification made to the surface based representation.

Claim 57 (cancelled)

Claim 58 (cancelled)

REMARKS

Applicants' attorney thanks Examiner Nguyen for the courtesy of a telephonic interview on September 14, 2004. In the interview, the undersigned discussed with Examiner Nguyen the pending claims, the Office action of August 4, 2004, and the cited art. The undersigned cordially invites the Examiner to call at the number below should any further information be helpful in the prosecution of this case.

Claims 1-12, 14-39, and 41-58 were considered in the Office action dated August 4, 2004. The Office action rejects these claims.

Applicants hereby amend independent claims 1, 25, 27, 28, 54, and 56, as shown in the preceding Listing of Claims, to include the limitation, "thereby simulating a deformation of the object while preserving surface detail". The amendments are supported by the application as originally filed, for example, in paragraphs [0059] to [0061]. No new matter is added thereby. Applicants also cancel claims 57 and 58 without prejudice.

Following entry of this Amendment After Final, claims 1-12, 14-39, and 41-56 will be pending in this application.

Independent Claims 1, 25, 27, 28, 54, and 56 Are Patentable Over Shih

Independent claims 1, 25, 27, 28, 54, and 56 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,552,722 to Shih et al. (Shih).

As discussed in the above-referenced telephonic interview, the invention provides an advantage over Shih in that it allows gross modifications of a virtual object, such as bending and stretching, without significant loss of surface details, while still maintaining a volumetric representation of the virtual object.

As described in paragraph [0061], methods of the invention allow more flexible interactive editing of volumetric models by supporting a wider range of operations, without compromising the strengths of a volumetric representation. This provides the ability to make relatively large, global changes to models even at a stage of model development where high resolution features have been applied to the surface of the model.

For example, the invention permits a model of a head to be modified by puffing out the cheeks without losing facial details, or in a model of an automobile, to add bulge to wheel wells without distorting the remainder of the vehicle. This is accomplished, for example, by converting a subset of a volumetric model to a non-volumetric representation, modifying the non-volumetric representation, and re-rasterizing to instantiate the changes in the volumetric model representation.

The independent claims have been amended to include the limitation, "thereby simulating a deformation of the object while preserving surface detail". Because Shih fails to teach or suggest every element of any of the amended independent claims, Applicants respectfully request that the rejection of claims 1, 25, 27, 28, 54, and 56 based on 35 U.S.C. § 102(e) be reconsidered and withdrawn.

Dependent Claims 2-9, 12, 14-21, 24, 26, 29-36, 41-48, 53, and 55 Are Patentable Over Shih

The above-listed dependent claims stand rejected under 35 U.S.C. § 102(e) as being anticipated by Shih. Each of these claims depends directly or indirectly from one of the amended independent claims 1, 25, 27, 28, 54, and 56, and includes all its limitations.

As discussed above, Shih fails to teach, or even suggest, every element of any of amended claims 1, 25, 27, 28, 54, and 56. Therefore, Shih fails to teach or suggest every element of their dependent claims, and Applicants respectfully request that the rejection of dependent claims 2-9, 12, 14-21, 24, 26, 29-36, 41-48, 53, and 55 under 35 U.S.C. § 102(e) be reconsidered and withdrawn.

Claims 10, 11, 22, 23, 37, 38, and 49-52 Are Patentable Over Shih in view of Tarr

Dependent claims 10, 11, 22, 23, 37, 38, and 49-52 stand rejected under 35 U.S.C. § 103(a) as being obvious over Shih in view of U.S. Patent No. 6,191,796 to Tarr (Tarr). Applicants respectfully traverse these rejections.

There is no suggestion in Tarr to combine its teachings with those of Shih to produce the invention of dependent claims 10, 11, 22, 23, 37, 38, and 49-52 because Tarr does not suggest creating a volumetric representation of a virtual object whose non-volumetric (i.e. surface-based) representation is modified by methods described therein. Likewise, Shih does not suggest modifying a non-volumetric representation of a virtual object to affect a change in a volumetric model of the object.

Because the motivation or suggestion to combine the cited references is not provided within the references themselves, nor in knowledge generally available in the art, Applicants respectfully request that rejection of dependent claims 10, 11, 22, 23, 37, 38 and 49-52 under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Claims 57 and 58 are Cancelled Without Prejudice, Rendering Their Rejections Moot

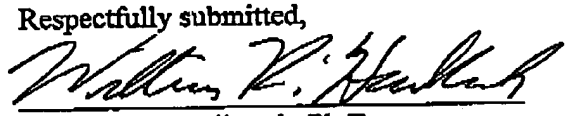
Claims 57 and 58 are cancelled without prejudice, rendering their rejections moot. Applicants explicitly reserve the right to pursue claims 57 and 58 in one or more continuation and/or divisional applications.

Conclusion

Applicants request that the Examiner reconsider the Application and claims in light of the foregoing Amendment After Final. Applicants respectfully submit that in view of the amendments and remarks herein, all of claims 1-12, 14-39, and 41-56 are in condition for allowance.

If the Examiner believes that it would be helpful to discuss any aspect of the Application by telephone, the undersigned representative cordially invites the Examiner to call at the telephone number given below.

Respectfully submitted,



Date: September 17, 2004
Reg. No. 53,002

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